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AUTOMATION OF KNOWLEDGE WORK JOBS: THE END OF THE MIDDLE-CLASS AND THE MARKET ECONOMY?

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Työ automatisoituu kun yritykset implementoivat uusia teknologioita toimintoihinsa jotka korvaavat ihmistyöntekijöiden aiemmin suorittamat työpanokset. Tyypillisesti automatisoitumisen lopputulos on, että yrityksen operaatiot tehostuvat ja työntekijä menettää työpaikkansa. Työn automatisoituminen yleensä kiihtyy kun uusia teknologioita kehitetään ja hyödynnetään.

Työn tehostumisesta johtuvaa työpaikkojen vähenemistä on ollut olemassa siitä asti kun yritykset alkoivat palkata vakituisia työntekijöitä. Syy tälle on se, että on yrityksen etujen mukaista automatisoida niin monta liiketoimintaan liittyvää operaatiota kuin mahdollista, sillä automatisointi tyypillisesti johtaa suurempiin voittoihin. Ensimmäinen automatisoitumisen aalto alkoi teollisen vallankumouksen aikana. Pääasiassa tämä aalto vaikutti ruumiillisen työn tekijöihin, ja sen vaikutukset ulottuivat aivan 1900-luvun lopulle asti. Sitten alkoi automatisoitumisen toinen aalto joka vaikuttaa pääasiassa tietotyön tekijöihin. Informaatioteknologian kehitykset ovat mahdollistaneet tämän automatisoitumisen aallon.

Tämän opinnäytetyön väite on, että tämän uuden työnteon automatisoitumisen aallon vaikutukset talouteen ovat erityisen ongelmallisia, sillä yhä korkeamman tason töitä kyetään nyt automatisoimaan. Tämä voi johtaa laaja-alaiseen työttömyyteen, koska tällä kertaa ei välttämättä ole jäljellä sellaisia työsektoreita joihin ihmiset voisivat ”yletä.”

Työn automatisoituminen ei ole ongelma itsessään. Suurin ongelma jonka se aiheuttaa on se, että työn automatisoituminen alkaa nyt vaikuttaa keskiluokkaan, joka on väitetysti tärkein ryhmä terveen markkinatalouden näkökulmasta. Jos merkityksellinen määrä keskiluokan työpaikkoja poistuu, tämä johtaisi talouden keskimääräisen ostovoiman pienenemiseen. Tästä aiheutuva heikentynyt markkinakysyntä voi johtaa taloudellisiin ongelmiin ja kenties jopa markkinatalouden tuhoon.

Vaikka työn automatisoituminen voi johtaa ei-toivottuihin taloudellisiin seuraamuksiin, on olemassa ratkaisuja joiden avulla voidaan lieventää, ellei jopa poistaa, odotettavissa olevia ongelmia. Tämän opinnäytetyön pohdinnan tulokset viittaavat siihen, että erityisesti julkinen sektori on se taho**,** joka voi ottaa näitä ratkaisuja käyttöön uusien linjauksien muodossa. Koska teknologista kehitystä ja siihen liittyvää työn automatisoitumista ei voida käytännössä pysäyttää vapaassa markkinataloudessa, ainoa vaihtoehto on ottaa käyttöön linjauksia jotka tukevat ihmisten hyvinvointia ja edesauttavat markkinatalouden eloonjäämistä.

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1 INTRODUCTION

People have feared losing their jobs to machines now for decades. Perhaps the first documented record of a group afraid that machines would take over their jobs and as a result, ruin their livelihood, were called the Luddites. This group was formed in the early 1800s in Great Britain when the Industrial Revolution was well underway (Hey 1997). The Luddites consisted of textile workers who opposed the labor-saving and wage-saving practices of factory owners who introduced new machinery into their factories. The main goal of this group was to terrorize the machines of those factory owners who refused their demands.

Ever since the times of the Luddites, many have lost their jobs to job automation. For example, before the Industrial Revolution the majority of the population in Great Britain were farmers. Now in industrialized countries, such as Great Britain, the percentage of the population who are farmers is only around one percent (Wallerstein 2014). This is one example of an industry that, over time, has become increasingly efficient and in need of less workers.

From a historic point of view, people have found employment in the new industries that have emerged as old ones have become more efficient. When farming practices became more efficient due to new technologies and improved practices, people found new employment in factories. Similarly, as factories became more efficient and in need of fewer workers, people shifted into the service and knowledge work industries.

Since people have historically found job opportunities in the new industries, a general belief has formed that technological unemployment is not a problem. It is assumed that technology always creates new industries which will always create new job opportunities.

It could, however, be argued that while the job markets have behaved in this way in the past it does not mean that they must continue to work this way in the future. Randall Collins (Wallerstein 2014) astutely reasons that this widely held belief is not based on an economic law. Just because new jobs have been created by technology, as old ones

have been eliminated, it is not a certainty that this pattern will continue forever. He argues that there is no reason to believe that the newly created jobs will be equal in numbers to the jobs that are lost, or that the income that will be lost by the middle-class will be replaced. What if this time it is different and the job opportunities that the new technologies create will not equal the ones they eliminate.

Brynjolfsson and McAfee (2014) bring forth an idea that what the Industrial Revolution essentially resulted in was that plain muscle power was automated through the numerous technological innovations like the steam engine. And that the new “IT revolution”, which we are experiencing at the moment, will automate our brain power. This is precisely where the problem resides. Now that the majority of people in developed economies have transitioned from manual work into knowledge work, many people may be left unemployed indefinitely if the majority of these knowledge work jobs are automated as well. Perhaps we ought to be concerned that this time it is different and that the accelerating, extremely disruptive, information technology innovations pose a more significant risk for human labor than we have expected.

Up until the 1980s and 1990s automation influenced the jobs that had a physical component to them, such as many factory jobs. Collins calls this the first wave of automation (Wallerstein 2014). The second wave, he believes, will result in information technology automating the current knowledge work jobs. According to Collins, the second wave of automation would eventually wipe out the entire remaining middle-class.

The vast majority of people in economically developed countries could be classified as being middle-class. For example, a large part of Americans consider themselves to be middle-class. As many as 80 percent of U.S. citizens, in the typical surveys that have been done, count themselves as middle-class (McLean 2009).

Interpreting the evidence of jobs disappearing from the middle-class, in combination with the understanding that a large part of the middle-class in economically developed countries consists of knowledge workers who are now coming into contact with job automation, it can be reasoned that major changes are to be expected in economically developed countries in the future.

In this thesis, I speculate that technological development has now come to a point where it collides with the labor market as well as the entire market economy. This potential collision could mean that economic growth would stall and the economy would go into decline. Eventually, this could lead to the dismantling of the entire market economy as technological innovations would disrupt the foundations that society and the economy. I propose that there is a real possibility that the weakened middle-class and the resulting decreased overall demand in the mass market would be the mechanism which would initiate the decline of the economy.

As technological development advances and more jobs are automated, technological unemployment will lead to a situation where consumers no longer have sufficient purchasing power that previously allowed them to purchase goods in the mass market. The decreased consumer demand will lead to decreased supply from businesses and the economy will shrink.

The major reason why, in theory, the financially weakened middle-class could lead to the decline of the market economy is focalized in the idea that the middle-class is the most powerful consumer group in the mass market. Generally speaking, economic growth relies on ever increasing demand. If the middle-class is forced to downshift its consumption habits, it is possible that overall demand will not be maintained at great enough level to support economic growth.

If vast amounts of middle-class jobs are automated, a time may come, when the laid-off workers, who are also consumers, do not have sufficient funds to spend on the mass market. The problem resides in the fact that middle-class workers are also major consumers in the mass market. In the long run, job automation leads to decreased purchasing power of the middle-class, which leads to decreased demand in the mass market. It can, therefore, be argued that the survival of entire market economy is in danger due to the disruptive advances being made within the field of information technology.

2 UNDERSTANDING JOB AUTOMATION

2.1. The power of technology: through a historic point of view

The main theme of this thesis is job automation which has been accelerating in the recent years due to technological advances. Even though it is not a new phenomenon, job automation has become a popular topic in the past few years. The reason for this is that people are becoming aware that job automation is now beginning to affect the field of *knowledge work* more dramatically. Many are rightly concerned because of this new development.

For decades job automation had occurred primarily in those jobs that could be categorized as manual labor jobs. These jobs have been under the pressure of being automated, arguably, ever since these jobs first appeared in the job market. Therefore, the entry of job automation to the field of knowledge work is a much more recent phenomenon.

It is important to understand that job automation is made possible by utilizing different kinds of technologies. Therefore, technology and job automation are closely linked to each other. And since it can be argued that job automation is not a recent phenomenon, a historic exploration into technological development and specifically how technology has affected jobs should provide valuable context for examining job automation in modern times.

Taking a historical point of view should also help in understanding what *a job* really is. This, in turn, should be helpful in understanding the nature of automation of jobs. In the following pages, the reader will learn how technology has affected jobs as well as the economy in a substantial way.

Before delving into jobs and job automation it is important to gain an understanding of just how powerful technology really is at shaping the world. The evidence of the power of technology becomes clear from a historical perspective.

Brynjolfsson (2014) begins the book *The Second Machine Age* by asking the reader what the reader considers having been the most important developments of human history. He follows up this question with numerous suggestions of major events that could all be proposed to be the most important development of human history. For example, Brynjolfsson mentions the transition from foraging to farming which enabled humans to form cities; the empires that were built through great wars; and the birth of the major world religions that influenced the thinking patterns of vast numbers of people. The main point of Brynjolfsson was to demonstrate that human history holds a vast number of important developments, but according to Brynjolfsson, the most important one started just over two hundred years ago. This was the beginning of the Industrial Revolution.

To support his argument Brynjolfsson cites the work of an anthropologist by the name of Morriss (2011) who, in *Why the West Rules - For Now*, quantified what he calls *social development*. Social development can be understood as “a group’s ability to master its physical and intellectual environment to get things done” (Morriss 2011, 142). The work of Morriss clearly demonstrates that, there has been no other time period in history like that of the Industrial Revolution as it relates to humans being able to take control of their environment. Progress, up to this point in history, had been relatively slow compared to the sudden acceleration of development characteristic to the Industrial Revolution.

What separated the Industrial Revolution from other important historic events was the technological progress that occurred during it. In fact, without the new innovations in technology the Industrial Revolution would not have been possible. The Industrial Revolution consisted of a number of different revolutionary technologies. In their sum total these technologies changed civilization drastically over a short time period. It did so first in Great Britain which was the birthplace of industrialization. From Great Britain industrialization spread to other parts of the world. Initially it spread to neighboring countries in Europe and later into the United States.

Out of the numerous technological developments of the Industrial Revolution there is one single technology that can be argued to have been the most important. This technology is the steam engine. Headrick (2009, 97) highlights the importance of the steam engine by stating that: “What made industrialization an ongoing and ever-expanding revolution was the invention of machines that could extract mechanical energy from the burning of fossil fuels.”

The first steam engines were inefficient and impractical for most industrial applications. However, they were used in coal mines and towns to pump water. The breakthrough that led to the creation of the *universal machine* of the Industrial Revolution came from James Watt. He was able to improve the steam engine and make it more efficient and practical for a larger amount of applications. Watt’s invention marked the beginning of a long string of improvements that: “made the steam engine the primary mover of the Industrial Revolution well into the twentieth century” (Headrick 2009, 99).

The rapid development of technology during the Industrial Revolution resulted in humans being able to control their environment in ever increasing levels. Steam power was adopted into sea travel, and eventually humans invented machines that would enable them to fly. In addition to gaining more control over the environment, technological advancements also gave certain countries an overwhelming advantage over populations of rest of the world. “Repeating rifles made of steel allowed small numbers of soldiers to defeat warriors with muskets, spears, or arrows… For those armed with the products of industry, war became a game rather than a challenge” (Headrick 2009, 124). The industrialized countries were also able to concentrate wealth into their own hands, while other parts of the world were either plundered by the industrialized countries or left to their own devices.

2.2. The birth of the job and the labor force

The origins of *work* reach far back into human history. If work is defined as, all of the regular tasks that humans need to do in order to survive, then humans have been working for practically their entire natural history. The evidence shows that our ancestors had learned to use simple tools 2.5 million of years ago (Donkin 2001). But the nature of

work has changed radically as people have transitioned from hunter-gathering societies into civilized ones.

Yet, even though work has been a consistent part of human existence, the specific form of work which can be described as a *job* is a relatively new invention. Particularly, from the perspective of job automation, it has not been very long that the types of jobs have existed which have been under the pressure of becoming automated.

In pre-industrial Great Britain, the vast amount of people were farmers. They worked in order to sustain themselves and to pay taxes to the ruling class. Even though farming was hard work it could not be described as being a job. At least not from the perspective of what we consider a job to be today. The ruling class owned the land which the peasants tended to. The peasants paid a tax to the owners of the land for the privilege of being allowed to farm there.

Since the focus of this thesis is job automation, it is logical to begin exploring human work from the time when the job, as we understand it today, was essentially born. Like most developments, it is not possible to specify the exact time and place of the birth of the job. However, the Industrial Revolution changed the nature of work from something that people did that directly contributed to their survival, such as the work of the peasant farmer, to work that a person performed in exchange for regular pay. And work that is performed in exchange for regular pay could be described as a job.

During the Industrial Revolution, the job began its transformation from first describing a piece of work that needed to be done to describing a constant source of labor which was tied to a regular income (Donkin 2001). From the cashbook of Abraham Darby, a British industrialist and owner of a forge at Ironbridge, it can be witnessed that work began to resemble regular employment. In the first year of the forge's operation one can see that workers were contracted for specific tasks, but soon what began forming was a group of regular paid individuals. Donkin writes about this specific development: "...the amounts they are paid usually (but not always) correspond week by week… it is beginning to look like regular employment" (Donkin 2001, 66). Essentially, Darby and his industrialist successors had begun creating the job.

As industry began growing in Great Britain, the industrialists required more workers to run the factories. They found the solution to this worker problem from the farming families that were in need of employment due to the agricultural revolution.

The beginning of the Agricultural Revolution is dated to the 18th century and is considered to be an essential prelude to the Industrial Revolution (Britannica Concise Encyclopedia 2006). The agricultural revolution played a major role in Great Britain as it allowed the transition from a traditional economy into an industrial one. The industrialization of agriculture provided factories with employment, as the now more productive farms did not require nearly as many workers as they did before the Agricultural Revolution. Donkin (2001, 83) writes that: “The surge in economic activity had increased the need for industrial labor at the same time that mechanization in agriculture had reduced demand for farm work.”

A number of factors contributed to the increased productivity in agriculture. Among them can be mentioned: technological innovations in farming equipment, more efficient infrastructure for transportation, and crop management innovations. But perhaps the most important change was the privatization of farmland that resulted from the enclosure movement. The enclosure movement involved removing rights from people to farm on common farmlands and established exclusive ownership. These changes lead to greater incentives for farmers to develop the efficiency of their farming practices. After all, they now had to compete in a central marketplace with other farmers. It could thus be argued that this new private, and market-oriented, way of farming led to the various innovations that constituted the agricultural revolution.

Additionally, the agricultural revolution also increased the crop yields in Great Britain. And larger crop sizes meant that there was more food for consumption. This surplus food enabled the growth of the population. Simply stated, more food equaled more people. The output from agriculture surpassed population growth in speed over the first half of 16th century. Afterward, productivity continued to be among the greatest in the world in Great Britain. The resulting abundance of food made it possible for the population to grow in England and Wales from 5.5 million in the beginning of the 18th century to more than 9 million by the beginning of the 19th century (Richards 1983).

And as there were now more people, there was also a larger pool of labor force for industry to use as employees. As farming became more efficient in the times of the agricultural revolution, suddenly there was less of a need for workers at the now private farms. A smaller amount of people could carry forth the tasks on the farms. Therefore, many people began moving into towns and cities to find work in factories.

2.3. Angry employees unite against job automation but factory owners resist

The first people that opposed job automation and the concurrent decrease in wages was a group called the Luddites. This was a secretive group that resorted to violent measures to get their message across to factory owners.

Luddites participated in machine breaking activities in 1811-12, with additional outbreaks in 1814 and 1816 (Hey 1997). The Luddites consisted of textile workers who opposed the labor-saving and wage-saving practices of business owners who introduced new machinery into their factories. Their violent actions took place in the factories where the new machines were threatening to eliminate the livelihood of workers through increased efficiency of production. The main goal of this group was to terrorize the machines of those select factory owners who refused their demands (A Dictionary of British History, 3rd ed.). Donkin (2001, 73) writes: “If machinery was not dismantled by its owners, the Luddites did the job themselves.”

The Luddites were not against machines, per se, and therefore did not direct their attacks on all factory owners who installed machines. Instead, they aimed their attacks only on those who did so while lowering rates of pay (Donkin 2001). Today’s popular culture may have labeled the Luddites incorrectly as technophobes, when in fact they were more concerned about what these new technologies would mean to their own ability to earn a decent living. It may, therefore, be more accurate to describe Luddites as a group that opposed business interests being placed above the value of human well-being. It could be argued that, therefore, they were mainly against job automation when it resulted in hardship to workers. The Luddite movement clearly demonstrates the development that was beginning to take place in industrial Great Britain, of efficient machines beginning to replace the work of people.

At the same time, the skill level of work was also changing. As machines automated work that skilled workers previously did by hand, there was a shift away from craftsmanship. In the beginning stages of the Industrial Revolution this transition could mostly be seen in the industrial crafts. Donkin provides a historical example of this development: “Handloom weavers, who had numbered almost a quarter of a million in 1820, had dwindled to no more than twenty-three thousand in 1856” (Donkin 2001, 75). Due to mechanization, production was now concentrating into factories and away from individual craftsmen.

Historically, when a certain practice spreads to a wider audience and new practitioners enter the market, the quality of the end product decreases. The entrance of new practitioners also drives down prices, as price competition is invariably the result of increased competition. This very same development happened during the Industrial Revolution as a result of increased machine production. The Industrial Revolution initiated a shift away from skilled work as craftsmen found that they could not compete with the prices that factory owners sold their products at (Donkin 2001).

Institutions called guilds, the roots of which can be traced to before the Middle Ages, were able to protect skilled work in Europe from quality decreasing forces, such as price competition, for long periods of time before the Industrial Revolution (Oxford Dictionary of the Renaissance). Guilds were a prominent part of the European economic system all the way up to the Industrial Revolution which began eroding the power of this institution. The erosion of the guilds coincided with the decline of skilled craftsmen. More formally defined, guilds were associations of craftsmen of the same trade that protected the common interest of the members (Oxford Dictionary of Phrase and Fable). Guilds were able to control aspects such as the price, through acting as a cartel controlling the purchase of raw materials and ultimately the selling of the final products (Epstein 1998).

The power of the manufacturing guilds, however, began to fade as factory owners were able to mass-produce products and sell them for lower prices than individual guild members ever could. One of the major factors for the decreased power of the guilds was, therefore, mass-production and especially the demand for these cheaper mass produced goods. It can, therefore, be argued that mass-production not only led to the

decreased quality of the goods being produced, but it also constituted a shift of power from the skilled workers of the guilds to the owners of factories. And while the mission of the guilds was to support skilled workers, the industrial system preferred more standardized workers. The reason being that standardized workers could be trained for jobs quickly, and if need be, replaced by another worker.

Factory owners often times used their power to decrease the wages of their workers. They were able to do so because workers had become easier to replace and there was a large supply of them to be trained for jobs.

2.4. Why job automation exists

To gain a better understanding of job automation, it is helpful to first understand who benefits from it and what their motivation for engaging in it is. Job automation exists because business owners aim to increase the efficiency of their operations as well as increase their savings. The ultimate aim being to increase the profits of the business.

The Merriam-Webster dictionary defines *efficiency* as: “effective operation as measured by a comparison of production with cost (as in energy, time, and money)” (Merriam-Webster's Learner's Dictionary). From this definition, employee efficiency can be defined as the amount that the employee produces in comparison to the cost of the employee to the business. Thus, the efficiency of an employee increases as production is increased or as cost are decreased. There are many ways of increasing employee efficiency. For example, the two most common ways during the Industrial Revolution were to make the employees work faster and to develop machines that would increase the efficiency of production.

A case can be made for the statement that, automation of jobs began as soon as the concept of the job was invented. As soon as business owners began hiring employees onto their payrolls these same employees became a part of the larger corporate machine. Since the general goal of any business is to produce a profit, and efficiency is one way of increasing profits, then it is logical that business owners would seek to

increase the efficiency of all parts of the business. This applies to employees, just as it does all other parts of the business.

Therefore, employees have been under the pressure of job automation ever since the job was invented. If business owners are able to make any part of their enterprise more efficient while keeping profits unchanged, then they will take the necessary action. If it involves automating an aspect of an employee's job, which usually leads to cost savings, the business owner is motivated to take the necessary action.

As already mentioned, one way that automation helps businesses to increase their profits is through cost savings. When the tasks of an employee are given to a machine to execute, the business has the option of letting the employee go. This decision would lead to cost savings for the business, as the comparative costs associated with machines can be assumed to be lower than the salary paid to the employee.

Decreased costs are, however, not the sole reason why businesses are motivated to automate certain operations. In some circumstances automation can lead to achieving greater levels of quality in production since machines have a competitive advantage over humans in performing some kinds of tasks.

Quite simply, machines are better than humans in performing certain operations. Therefore, job automation does not always merely lead to business operations being performed more cheaply, it can also lead to the operations being performed better. What follows are examples of various tasks that machines have an advantage in compared to humans.

In the manufacturing process of many products there are certain procedures that require extreme accuracy. Machines are often better than humans in performing such precision requiring procedures. The human body simply is not accurate enough to perform many of the tasks involved in modern production. Manufacturing a microchip for a computer would be one example of such a procedure. In addition, machines are often faster than humans in performing numerous task. This applies to tangible steps in the manufacturing process as well as to such intangible operations as performing mathematical calculations.

Reliability is another advantage that machines have over human workers in many cases. Machines do not tire as they are not subject to the same biological limitations that humans are susceptible to. Machines can work around the clock, and they are much easier to manage since they do not have a will of their own.

Consequently, machines are superior to humans in performing many business related operations. There are undoubtedly numerous other aspects in which machines outperform human worker, however, the point here was to essentially establish the idea that machines are better options for businesses in some parts of their operations.

But the pursuit of increased efficiency and quality is not the only reason why businesses pursue job automation. The competitive nature of markets is also a force which leads to increased levels of automation. Perhaps the easiest way to understand why businesses need to embrace job automation, in order to compete in the marketplace, is from the perspective of the customer. In simplified terms, customers make their purchasing decisions based on the price and the quality of the product. In many instances automation can make it possible for businesses to sell their product at a lower price and also produce a superior product compared to their competitors. In theory, automation enables lower sales prices of the final product since in many cases automation helps to lower manufacturing costs. Additionally, incorporating more advanced technologies into the manufacturing process, as well as into the features of the final product, can lead to a superior product compared to others in the marketplace.

As noted earlier in this chapter, technological advances gave many countries throughout history a competitive edge over others which they often used to exploit the less advanced countries (Headrick 2009). Similarly, the businesses that are able to utilize new technologies in their operations will have a competitive advantage. The resulting advantage can be used to increase market share and potentially to even bankrupt the competition. It is, therefore, almost a necessity for businesses to stay on the cutting edge of technological developments. The businesses that are able to use new technologies in the most efficient ways are the ones that survive in the long run.

One sector that is currently experiencing a fast pace of development is information technology (IT). And the application of IT related advances are not only limited to the businesses that operate in the IT industry. Nearly all businesses have to incorporate information technology related advances into their operations in order to stay competitive in the marketplace. One example of such businesses would be retail sellers who are increasingly moving into the online marketplace. It is becoming more challenging for the traditional *brick and mortar* stores to compete with online retailers. The main benefits that online retailers are able to provide consumers with are lower prices, convenience, and various other benefits such as a larger variety of products. And consumers have been moving towards spending their money online for several years now, which has caused decreased profits for many traditional brick and mortar stores. During the year 2014, global e-commerce sales grew by more than 20% to nearly 840 billion dollars. While *Euromonitor* estimates that the growth rate will not continue being equally high in the coming years, they nevertheless, estimate that e-commerce sales will continue growing (Ben-Shabat 2015). This is an example of one business sector in which businesses must adapt to the new market environment that technological advances have helped shape.

2.5. First we automated mechanical power, the next step is to automate brain power

New technologies not only shape society at large, they also shape the available jobs in the economy. History gives credibility to this statement. As noted previously in this chapter, the technological advances that took place during the Industrial Revolution affected that era's jobs dramatically. For example, the ability to mass-produce certain goods made the jobs of many individual craftsmen redundant as they were unable to compete in sales prices. While on the other hand, as factories became even more efficient, many of the factory workers found themselves without jobs as well.

Jobs have thus for a long time been closely intertwined with technological innovations. Technology changes the types of jobs that are needed in the economy. It dictates how jobs are performed as well as which jobs are actually necessary for people to perform.

The Industrial Revolution was a time period during which many routine based mechanical jobs were automated. The main technological advancements during those times were technologies such as the steam engine, which provided a more efficient source of energy as compared to the physical power of a human. Additionally, factories were incrementally designed in ways that minimized the need for workers. Essentially, the Industrial Revolution initiated the automation of simple routine based physical labor.

Throughout time, as technological innovations began enabling the automation of ever higher level of physical tasks, people began transitioning away from manual labor jobs. The chart below depicts the distribution of the labor force by sector in the United States from 1840 to 2010. Pay special attention to how the sectors which primarily employ manual workers, *industry* and *agriculture*, have behaved compared to the *services* sector.

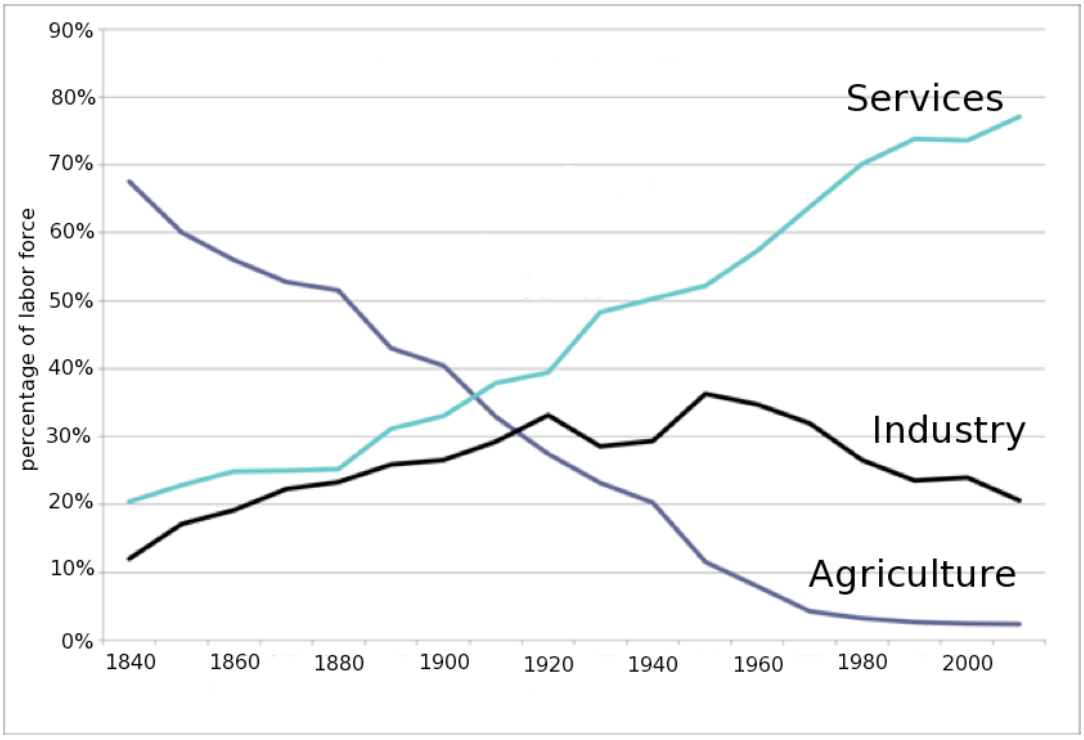

Figure 1. Distribution of the U.S. labor force by sector between 1840 and 2010; Johnston 2012.

The chart shows that around 1910 and 1920 all three sectors employed roughly the same portion of people out of the labor force. After this time period, the chart shows industry and agriculture going into a decline while the services sector sees an increase

in workers. Clearly there has been a radical transformation in the type of work that the labor force is engaged in from the middle of the 19th century to the beginning of the 21st century. The move has been primarily from physical labor towards service work.

An important question is, will it be possible for the service industry to keep on employing more people? It could be argued that the same kind of productivity increase that happened in manufacturing and in farming could also happen in the service industry. Previously the domain of the service industry was not affected significantly by job automation, the reason for this being that the technologies had not yet been developed that could rival any of the information processing abilities that humans possess. However, this all is changing before our eyes.

The new wave of technological advancements is happening primarily in information technologies. It is argued in this thesis that these technological advances will cause dramatic changes to the jobs that people perform currently, especially within developed economies, as a large percentage of people in developed economies work in service jobs and knowledge work jobs.

In *The Second Machine Age*, Brynjolfsson and McAfee (2014) bring forth the idea that the Industrial Revolution could be viewed as the first *machine age* as it was characterized by the invention and utilization of revolutionary machines that transformed the entire world. As for the second machine age*,* they have this to say: “Now comes the second machine age. Computers and other digital advances are doing for mental power - the ability to use our brains to understand and shape our environments - what the steam engine and its descendants did for muscle power” (Brynjolfsson 2014, location 107). While Brynjolfsson and McAfee predict that the innovations of the second machine age will lead to numerous beneficial results for humanity, they also acknowledge that the new technologies will wipe out the need for a certain type of work. Perhaps the most significant effect that these new revolutionary technologies will have will be on certain knowledge-work jobs. Particularly those knowledge-work jobs which can now be automated through the aid of new technologies. As the vast majority of workers in economically developed countries are now engaged in knowledge work jobs, the automation of these jobs could lead to high levels of unemployment.

3 THE JOBLESS MIDDLE-CLASS

3.1. The large middle-class: a phenomenon that may be over

It is important to first establish how the somewhat vague term, middle-class, is defined in the context of this thesis. The middle-class is largely a subjective definition of a specific social group which in today's economically developed countries encompasses the vast majority of the population. Typically, the term is used to define a social group with a similar work and market situation. However, there is no agreed upon cut-off points for individuals who belong to this class and those who do not. Therefore, it may be helpful to understand the modern middle-class through the term *the middle-mass.* This term emphasizes that the middle-class consist of people who earn wages in a range close to the average income (A Dictionary of Sociology, 4th ed.).

If an income based perspective is taken into defining the middle-class, then it is not possible to define all of the different types of work that would be "middle-class work." While previously *white collar* jobs were nearly synonymous with middle-class jobs and *blue collar* jobs were considered working class jobs, now the boundaries between these two different kinds of work are fading. Many blue collar jobs now pay a salary that is close to the average income or even above it. Therefore, it is not possible to make sweeping statements about what kind of work the middle-class is engaged in (McLean 2009).

Even though defining the middle-class is not a simple task, this class still shares some common characteristics among the people in it. Perhaps most importantly, the middle-class has to work in order to make a living. This sets the middle-class apart from the class that is above them in the social order which can be called the upper class. Individuals within the so-called upper class sometimes have the option of not working and instead living off of the wealth that they have amassed or that they have inherited.

In addition to a similar work situation, the middle-class is generally a well-educated class. Education sets the middle-class apart from the class that falls below them which

could be called the working class. Although, perhaps a more accurate term in today's developed economies would be the *working poor*.

The third characteristic that is widespread in the modern middle-class is consumerism. Purchasing products that are common amongst other middle-class members is held as a sort of badge of material success. This is yet another characteristic that sets apart the middle-class from the class below them whose members are typically not able to engage in consumption with the sole purpose of strengthening their social status (Stearns 2008).

For the purposes of this thesis, which takes a broad view, it is not necessary to come up with a very specific definition for the middle-class. The people and households that earn a salary that gives them the possibility to fulfill the characteristics explained previously — working to make a living, higher education, and consumerism — can be defined as being middle-class. A broad definition of the middle-class will suffice.

It could also be argued that the middle-class has grown into the largest single class in economically developed countries. A large part of Americans would classify themselves as middle-class. As many as 80 percent in the typical survey that has been done count themselves as middle-class (McLean 2009).

It is safe to say that the middle-class has been steadily expanding for many decades. Industrialization and the accompanying economic growth has been crucial to the expansion of the middle-class. However, this growth may now be at its end. The argument of this thesis is that we are now entering into an era where the middle-class will be shrinking in size since many middle-class jobs will be eliminated through technologically driven job automation.

The chart below shows the *Civilian unemployment rate* of the United States from 2007 to 2016.

Figure 2. U.S. civilian unemployment rate; US. Bureau of Labor Statistics 2016.

From 2008 to 2010 the chart shows that the national unemployment rate grew from approximately 5 percent to 10 percent. The chart also shows that the unemployment rate began decreasing at a steady pace from the high point of 2010. According to these statistics, by the US. Bureau of Labor Statistics, the beginning of the year 2016 has brought unemployment numbers to the same level as they were in the beginning of 2008. Based on these statistics it could be stated that, the United States labor market has recovered from the 2008 financial crisis.

Understandably, unemployment figures have not been impacted in the same way in all countries relating to the financial crisis of 2008. I will, however, use the United States as an example in assessing how employment has changed after the financial crisis.

According to the U.S. civilian unemployment rate, employment has again reached pre-recession levels. But while unemployment has decreased to the approximate levels as they were prior to the financial crisis, there is evidence that the jobs that were recovered were predominantly of lower quality and of lower wages. During the recession, jobs were lost in all different wage groups but the vast majority were in the mid-level wages group. This group accounted for 60 percent of the job losses. By contrast, during the recovery most job gains have been made in the low-wage group. These jobs account for 58 percent of the recovered jobs. These findings were published in 2012 (Bernhardt 2012).

The *NELP Data Brief* lists some examples of the low-wage jobs that saw growth during the recovery after the financial crisis: food preparation workers, laborers and freight workers, waiters and waitresses, personal and home care aides, and office clerks and customer representatives. The hourly wages in the low-wage group were specified as being between 7.69 and 13.83 dollars.

These findings, of increases in low-wage jobs and decreases in mid-waged jobs, supports the theory that middle-class jobs are decreasing. The *NELP Data Brief* also includes a chart that shows occupational growth rates in different wage groups from 2001 to 2012.

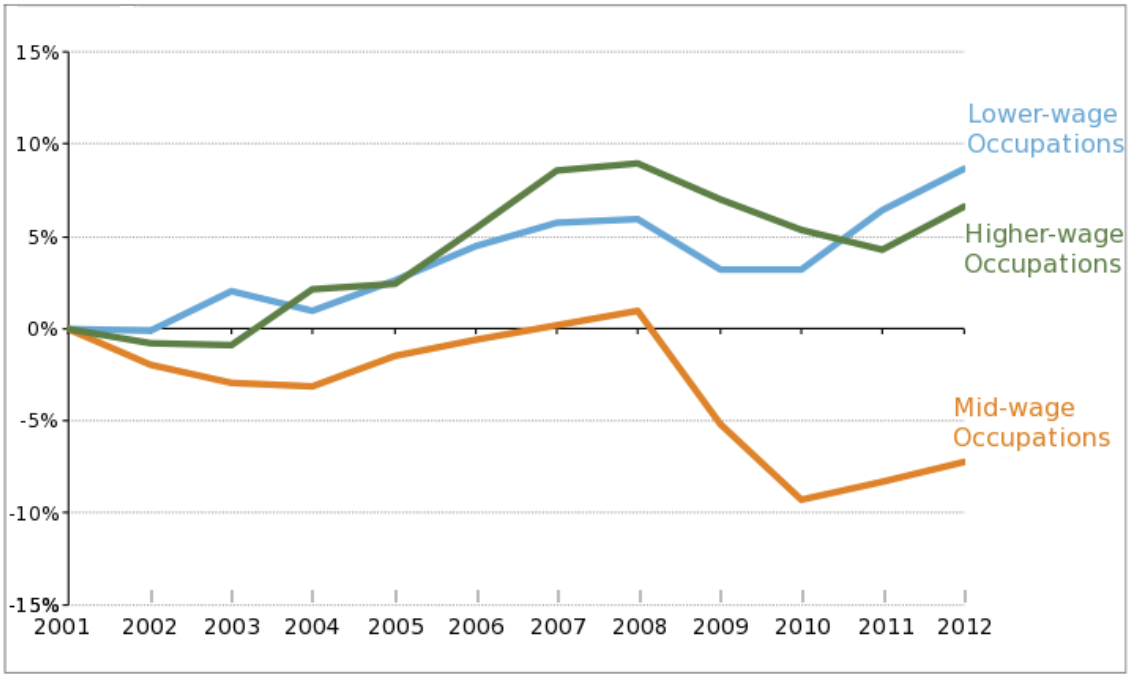

Figure 3. U.S. Occupational growth rates between 2001 and 2012; Bernhardt 2012.

Lower-wage occupations and higher-wage occupations have behaved quite similarly, while mid-wage occupations appear to have decreased in numbers from the levels prior to the financial crisis. One possible explanation for this development is that businesses no longer have as large of a demand for mid-wage occupations.

The research done by Autor (2010) also supports the fact that the demand for mid-wage jobs is decreasing. According to Autor, this has been the case in the US for three

decades now. Autor writes that the polarization of wages has been an ongoing issue in the US labor market and that it is a development that has been going on even before the financial crisis. Polarization refers to the relative increase in demand for high-skill, high-wage jobs; and low-skill, low-wage jobs; as compared to mid-skill, mid-wage jobs. Autor states that: “The Great Recession has quantitatively but not qualitatively changed the direction of the U.S. labor market” (Autor 2010, 13). By this he means that the trend of decreased demand for mid-skill, mid-wage jobs has been active even before the financial crisis, and that the only thing that the financial crisis did was that it reinforced the trend.

Autor (2010) attributes this trend of decreased demand for mid-skilled jobs to two specific reasons. The first being the automation of routine work and the second being the international integration of the labor market. These two trends seem to have had a disruptive impact especially on mid-skilled jobs because of the nature of most of these jobs. In many cases, mid-skilled jobs are more routine based than high-skill jobs or, surprisingly, even many low-skill jobs. The routine based tasks that many mid-skill jobs consist of make it a possibility to either automate them or to move them off-shores. Routine tasks, which are possible to be defined as an *algorithm* can be performed by machines, and job tasks that can be reduced down to simple instructions can be outsourced to cheaper workers in developing countries.

There is a simple explanation for why low-skilled jobs or high-skilled jobs are not as prone to being automated or off-shored to cheaper countries. In short, the explanation is that low-skilled and high-skilled jobs are typically based on non-routine tasks. These non-routine tasks can be divided into two main groups: abstract tasks, which are commonly performed by high-skill workers; and non-routine manual tasks, which are typically performed by low-skill workers. Examples of the abstract tasks performed predominantly by high-skill workers would include: problem solving, intuition, and persuasion. Then there are the manual non-routine tasks usually performed by low-skill labor. These manual tasks typically require situational adaptability, visual and language recognition, and in-person interactions (Autor 2010). A good example of such a job would be a janitor or a cleaner. While these jobs are relatively routine based, these kinds of workers are, nevertheless, exposed to day-to-day situational variability. Therefore, they cannot be written easily as computer code and delegated to a machine.

Additionally, because these jobs are tied to a specific physical location, it is not possible to outsource them to a developing country. In contrast, many mid-skilled manual jobs performed in a factory setting are increasingly under the threat of being automated or outsourced. In many instances, if a physical task can be relatively easily charted down to specific routine steps, then it can be outsourced to countries with cheaper labor. Similarly to mid-skilled blue collar jobs, many mid-skill knowledge work jobs do not require much mental adaptability and can often be performed by following rather simple steps. Because of the constantly improving quality in computer and communication technologies, accompanied by declining prices, many of these white collar jobs have been reduced down to code that a computer is able to execute on, or the job has been sent to be performed at an offshore location offering cheaper labor.

This polarization of the labor market correlates with the decreased demand for typical middle-class jobs. While Autor has studied the labor market of the U.S., his finding should also be relevant for other economically developed countries. It can be argued that, in the long run, the demand for mid-skill level jobs will decrease in all economically developed countries. The higher the wage level of the particular country, the more incentive the businesses that operate there will have to either automate jobs by the aid of computers or to offshore them to countries of cheaper labor.

3.2. Which jobs will be automated

"*Computers now replace humans in carrying out an ever widening range of tasks - filing, bookkeeping, mortgage underwriting, taking book orders, installing windshields on automobile bodies - the list becomes longer each year*" (Levy and Murnane 2004, 1).

The next phase of job automation is expected to affect knowledge workers more significantly than manual workers. Manual workers have been in touch with job automation for much longer than knowledge workers have. In fact, the automation of manual work began as early as in the beginning of the Industrial Revolution. The Industrial Revolution initiated a process that essentially automated human muscle power by replacing it with increasingly efficient sources of power such as steam power. These technological developments have led to a world where, at least in industrialized

economies, the value of the kind of work that only utilizes physical strength is extremely small. It could, therefore, be stated that the simplest of physical labor has already been automated entirely.

So while the Industrial Revolution automated muscle power, the recent rapid developments in information technology have begun automating the information processing capabilities that humans possess. The next wave of automation will thus involve automating information processing within jobs. Information processing is a component of both knowledge work jobs as well as manual work jobs.

We now live in a time where even the people who are categorized as being manual workers actually utilize plenty of information processing in their jobs. While they may be categorized as manual workers, they still process plenty of information within their jobs. As a general rule, it could be said that nearly all of the manual work jobs that only involve the use of muscle power have already been automated. The manual work jobs that remain in the job market do so because they also entail a component of information processing to them. It is this component of information processing that has prevented them from being automated in the past.

It is clear that people cannot perform knowledge work jobs without processing information. However, one cannot perform the tasks of a manual worker's job without processing information either. So in a way, all jobs are knowledge work jobs, to some degree.

To illustrate this point further, we can look at some examples of jobs which are not exclusively knowledge work jobs nor purely manual work jobs either. For example, the job of a surgeon requires complex information processing yet it also entails a significant manual component of performing surgeries by hand. In comparison, a garbage truck driver utilizes information processing as well but at a much lower level of complexity than a surgeon.

Both knowledge work jobs and manual work jobs entail information processing tasks. The more complex the information processing within the job, the harder the job is to automate using the computer technology available to us today. In industrialized

economies the tasks of manual work have been automated to a point where the manual work jobs that remain have a significant component of information processing tied to them. The next frontier of automation will be one where, at least some, information processing tasks are automated.

As information technology is the specific form of technology that is developing at the fastest pace in today's world, a theory could be proposed that knowledge work jobs will be the ones that are going to be under the greatest pressure of automation in the forthcoming years. For this reason, we will focus on assessing the effects of automation on jobs that possess a large component of information processing. In most cases these jobs would be categorized as knowledge work jobs.

The automation of knowledge work jobs can be harder for the human mind to comprehend, compared to the automation of physical labor jobs. When physical labor is automated it leaves behind it a "visible trail." For example, a robot may be introduced into the production process of a factory which directly replaces a person who used to perform the same task. The automation of knowledge work jobs is not as easy for the human mind to comprehend because knowledge work is invisible and performed silently within the mind.

In order to estimate what type of knowledge work is most under the threat of becoming automated or taken over by machines we need some way of categorizing them and separating them from each other. So-called knowledge work encompasses a vast amount of different kinds of jobs and tasks that utilize different kinds of mental processes. The one thing in common between them is that they all require mental resources. But these mental resources can be divided into separate categories, some being easier to automate than others.

Jobs can be categorized according to various different classification systems. There are very comprehensive labor categorization standards such as the International Standard Classification of Occupations (ISCO), which is an International Labor Organization (ILO) classification structure for organizing information on labor and jobs. This classification system is based on the tasks and duties performed in each job (International Labor Organization 2004). However this job categorization system, like most others, cannot

effectively be used to determine which job categories have the greatest likelihood of being exposed to the forces of automation. To illustrate this point, we can examine one of the major job groups in this classification system: “Service and Sales Workers.” Within this rather large group there are various different sub-groups of workers, all which differ in their respective likelihood of becoming automated in the future. A sales worker, whose job consists primarily of cold calling potential clients and using a script to aid dialogue, is much more in danger of losing the job to automation than a salesperson who partakes in face-to-face interactions and has to use higher level cognitive skills to guide the sales process. This example illustrates the point that even jobs within the same category, such as “Service and Sales Workers”, are not susceptible to the forces that lead to automation in the same degree. Therefore, it is not possible to use the kinds of categories found in systems such as the International Standard Classification of Occupations (ISCO) to determine which jobs will most likely be automated in the future.

In a similar fashion, it is not possible to use education level as a straightforward means of determining the likelihood of automation happening to a certain group of individuals. While higher education levels generally prepare individuals to be able to occupy jobs where more complex knowledge work is being performed, it cannot be said that as a rule higher education level equals entry to jobs which are safer from automation. Many jobs that require only low-level education, such as cleaners, are still relatively safe from automation. While on the other hand, jobs that require mid-level education levels, such as clerical workers, are more likely to see their jobs being automated because many of the tasks of these jobs can be automated with today’s information technology. As discussed previously, it is actually the mid-skill jobs that are most likely to be automated first. These mid-skilled jobs are typically matched with employees who have mid-level educations.

It can be argued that, instead of using education level or the type of work as meters to determine how likely the corresponding job is to be automated, it might be beneficial to use job-skill type and job-skill level to confront this problem of which knowledge work jobs will most likely be automated in the future.

As Autor (2010) points out, the United States has seen jobs automated mostly in the mid-skill level. This means that many mid-skill level knowledge work jobs have been

transformed into tasks that computers can run, or they have been outsourced to developing countries where cheaper labor is able to execute on relatively simple instructions. Therefore, in many instances, the knowledge work tasks that are based on routines have already been automated. According on these findings it is safe to say that routine based knowledge work, which could be categorized as low skill knowledge work, is the easiest to automate. In contrast, the higher skill information processing tasks, which are typically the domain of high-skill knowledge workers, have been safe from the forces of automation for the past three decades. The research of Autor (2012) shows that high-skill jobs have not seen similar effects of unemployment as the category of mid-skilled jobs. Thus, a theory could be proposed based on empirical evidence of changes in the labor market and understanding of how computers work, that lower-skill knowledge work jobs are more suspect to being automated than high-skill knowledge work jobs. In general then, the easier a knowledge work task is to be written into code or reduced to a set of simple instructions, the easier it is to automate either by a computer program or outsourced to a worker in a developing country.

3.3. Humans still outperform machines in many jobs

We must accept that machines are better than humans in carrying out certain tasks. This applies especially to routine based tasks. For example, a computer can perform much more calculations than a human can in a given time period. If this is acknowledged as the truth it makes sense that people should not try to carve out careers that are based on tasks that machines excel at. From an economic standpoint, it would be wise to leave machines to do the work that they are best suited for while people should focus on the tasks that they have a competitive advantage in.

Computers, of course, have their limits. There is, however, one class of tasks that they are specifically good at which is carrying out rules-based tasks. "... computers' comparative advantage over people lies in tasks that can be described using rules-based logic: step-by-step procedures within an action specified for every contingency" (Levy and Murnane 2004, 16).

Some examples of work related tasks that can be written in step-by-step, rules-based logic, include: processing mortgage underwriting applications; all actions performed by an ATM machine that were previously performed by a bank tellers; searching for the best hotel deals; online book purchasing; and inventory control. The list could go on and on.

There are, however, limits to the tasks that computers and other machines can perform. They are extremely efficient in carrying out rules-based tasks but very lousy at performing certain other kinds of tasks. Without getting into specifics, it is easy to imagine that most of the work that people perform cannot be written into scripts that could then be run by machines. Many of these are important job tasks and are much better performed by people.

While machines have an advantage in performing certain types of tasks, machines are not as versatile as humans. Humans, of course, have the ability to perform rules-based tasks just like computers. But again, it is not the best use of human energy. Humans can do much more than simply follow rules. In fact, one of the things that humans are still better than machines at is a skill called **pattern recognition**.

To understand the capabilities that pattern recognition gives people, we can look at an example of one specific job that utilizes it extensively. Consider a taxi driver who drives a cab on a busy city street. The driver must process a great deal of information as he makes driving decisions in the midst of people crossing streets and maneuvering his vehicle in relation to others vehicles.

In this environment, the driver uses his pattern recognition abilities extensively. He is constantly running into new situations, or patterns, which his brain is able to interpret based on previous related memories. In other words, the driver perceives a situation with his senses, he then interprets the situation based on previous similar experiences that are stored in his memory. This information processing and decision making come naturally to the trained taxi driver. But it is the result of extensive study and experience. It is hard to imagine that these capabilities could be programmed into a computer.

Another example of pattern recognition can be seen in situations where people use their creativity.

> Pattern recognition is also important in the process of creating something new through what cognitive psychologists call “case-based reasoning.” For example, an advertising writer is asked to develop a campaign for a new spaghetti sauce. She has never done an ad campaign for spaghetti sauce, but she has done ad campaigns for other quick-to-prepare meals and her knowledge of those cases gives her a useful starting point for thinking about the sauce (Levy and Murnane 2004, 23).

In addition to pattern recognition, which humans still outperform machines in, humans are also better than machines in the important skill of **complex communication**. There are many situations that arise within jobs and day-to-day life where people rely on the ability to communicate with each other to achieve desired outcomes. Humans are able to interpret context, small cues in speech and body language, and emotions behind the communication. The complexity of dealing with human beings effectively is not an easy task to program into a computer.

It is important to admit that machines are better at performing certain tasks that humans could also perform. However, due to the economic benefits of automation, these tasks will be directed to machines within all businesses that aim to make a profit. The wise employee positions herself in a way that allows for her to produce value in the marketplace which is saturated with machines that can perform certain tasks more efficiently than humans.

3.4. Machines have their limits but they are developing surprisingly fast

When automation began entering factories in the 20th century, many were displaced from their jobs. Luckily a large number of people were able to transition to knowledge work jobs and find an income for themselves and their families through a different kind of work. For many decades, knowledge work jobs were a sort of “safe haven” from

automation. There were simply no technologies during those times that could rival a human's brainpower to perform tasks involving information processing.

Because of advances in information technology it seems that knowledge work jobs, as a whole, are not a safe from job automation any longer. Automation has entered the domain of knowledge work. As computers continue to be able to perform knowledge work related tasks more efficiently and cheaply, humans are facing tough competition.

The book *New Division of Labor* by Levy and Murnane (2004), which I have cited extensively in this subchapter, was written in the year 2004. At the time of its writing, Levy and Murnane reasoned that there was a limit to the level of tasks we could employ machines to perform. They reasoned that certain tasks were out of the scope of the abilities of machines and that these tasks would continue to be performed only by humans.

One of these abilities is pattern recognition. Humans are masterful at detecting patterns through our senses. When a taxi driver drives through a crowded city, he is making use of his ability to detect patterns and make rapid decisions on the basis of the input that he receives through his senses. To the driver, much of this happens unconsciously and he will most likely be able to even hold a conversation simultaneously with a passenger.

This is exactly the kind of complex pattern recognition that Levy and Murnane could not see machines doing very well. The main reason being that it is extremely hard to write an algorithm for something as complex as driving a car in a crowded city. There are so many variables to take into account and so many unconscious processes to take into consideration that it would seem to be impossible to ever automate such a task as driving a taxi. But fast forward to today and Google has already had self-driving cars driving autonomously in traffic for several years. Google officially started its Self-Driving Car Project in 2009, and in 2016 Google reports that their self-driving cars have driven more than 1.5 million miles in various U.S. cities (Google Inc. 2016). Information technology is moving forward at such a rapid pace that it is hard for us to comprehend the speed. It is opening up possibilities that we thought would be impossible just a few years prior.

Levy and Murnane also wrote about complex communication being a skill that would stay in the domain of human work. This makes perfect sense since what could be more complicated than mapping out an algorithm for human conversation? Numerous processes are required of us to even hold a simple conversation with another person. One has to interpret the physical cues of the other person, assess what the voice tones are signaling, understand what is being said, and a myriad of other interpretations that humans make quite easily once they have reached a certain level of proficiency.

There are not yet technological inventions that could rival humans in the area of complex communication. However, there certainly are projects in development that are beginning to take over some aspects of communication that previously were strictly in the domain of humans. We saw, how only a few years after Levy and Murnane wrote about it being extremely hard, or even impossible, to rival the pattern recognition of humans, that Google announced that it had begun developing a self-driving car. It might be foolish to state that we could not someday develop technologies that could perform complex communication as well. There are already voice recognition technologies such as Apple's Siri which is now linked to many Apple devices (Apple Inc. 2016). Siri performs as a sort of digital assistant. The user of an Apple cell phone, for example, can ask a question verbally and direct it to Siri. Siri will give an answer to the question or perform a certain function via the cell phone that the user has requested. This technology is far from being perfect at the moment of writing, but nonetheless, it is a technology that is moving into the domain of communication. Not yet *complex* level communication but perhaps that day will come soon.

3.5. The future of the middle-class

Randall Collins, in the book *Does capitalism have a future?* (Wallerstein 2014), predicts that technological development will cause the middle-class, as we currently know it, to disappear.

He states that before the 80s and 90s working class jobs were replaced by mechanical machines. This was a part of the first wave of technologically enabled automation. He believes that we are now entering the next wave of automation which will eventually

wipe out the entire remaining middle-class. This second wave is a result of information technology automating the current knowledge work jobs. He writes that IT is the technology of communication and that the work of the current middle-class is that of processing information and communicating it.

Collins states that there is a widespread belief circulating amongst people that, we should not be afraid of technology taking away jobs since technology always creates new ones to replace the old ones that are lost. This belief is not without grounds since history has proven this to be quite accurate so far. But Collins reasons that this belief is not based on an economic law. Just because new jobs have been created as old ones have been eliminated by technological developments, it does not mean that this will continue as a pattern forever. He does not oppose the idea of new technologies creating new jobs, but he does remind us that there is no reason to believe that the newly created jobs will be as many in numbers as the jobs that will be lost, or that the income which will be lost by the middle-class will be replaced.

Collins predicts that artificial intelligence will make many knowledge workers obsolete. Artificial intelligence might thus be the technology that automates the remainder of jobs once held by the middle-class. Technology has been automating one job sector at a time from a historic perspective. There was once a time when the majority of people were farmers. Now in developed economies the percentage of the population who are farmers is somewhere around one percent. Quite similarly, factories have dropped from employing 40% of the working population, down to only 15% or less (Wallerstein 2014). Collin's opinion is that a similar reduction in employment will most likely happen in administrative and service work jobs.

The percentage of the labor force which works in the service sector has risen all the way to employing 75% in a developed economy such as the United States, as jobs have been lost in manufacturing, farming, and other manual labor (Autor & Dorn 2009). Now information technology is disrupting the jobs in the service sector as well. Collins sees no end to this development if we do not interfere with the force that ultimately drives job automation: capitalistic competition.

Globalization is another force that is threatening the existence of the remaining middle-class. Now many of the white collar jobs of the upper middle-class are merging into one global workforce offering similar labor services. Thanks to the internet, people from India or any other developing country can offer their know-how and expertise to the businesses that are based in economically developed countries. Ultimately this leads to a situation of higher competition for work among the white collar workers in economically developed countries. The higher supply of available global knowledge workers brings down the wage levels that are offered for this type of work. As the significance of country borders is decreasing, due to technologies such as the internet, knowledge workers in the west are faced with yet another challenge in the form of increased job competition (Wallerstein 2014).

At the time of writing, artificial intelligence has not yet shocked the labor market of knowledge workers but Collins predicts that it will be a massive disrupting force in the future. He writes that we have not yet developed an advanced enough AI that could emulate the flexible and creative thinking that humans are capable of. He states that the more advanced AI we are able to develop, the higher level knowledge work it will ultimately replace. While many may still believe that their knowledge work job is safe from any sort of automation, if Collins' predictions become true, there are very tough times ahead for knowledge workers and ultimately the entire global capitalistic system.

Collins is of the opinion that these developments in technology and the decline of the middle-class will lead to the end of the entire capitalistic system. When jobs have been replaced by technological solutions, people will not have money to spend which will lead to demand plummeting in the mass market. Collins believes that this all will transpire in the next 30-50 years.

4 THE END OF THE MARKET ECONOMY

4.1. Job automation and the challenges it causes to the market economy

It is widely accepted in economic growth theory that technological development is a factor that enables long-term economic growth. It is, however, possible that the virtuous relationship that has existed between technological development and economic growth is now approaching its end.

In the basic *supply and demand* model, technological development leads to productivity gains in the economy. The realized productivity gains, in turn, affects the supply curve in a way that the available supply occurs at lower prices. The lower prices in the economy then lead to increased demand and the economy grows. In the Solow-Swan model, technological development enables production to be done with fewer resources. The need to use fewer resources in the production process provides an opportunity to increase levels of investments. As a result, the economy grows (Solow 1956; Swan 1956). Romer (1986) and Lucas (1988) made technological development into an endogenous variable in their model of economic growth. Thus, they made an improvement to the Solow-Swan model which assumes technology to be an exogenous variable. The purpose of bringing up these separate models for economic growth is to demonstrate that technological development has been an integral part in all widely recognized models for economic growth.

I, however, propose that there is a strong possibility, as technology continues developing, that the economy will not continue growing as the different growth models predict. The reason being that there may be a point where technology has developed to such a high level that a vast number of jobs can be automated. When this level is reached, technological unemployment will have led to a situation where consumers no longer have sufficient incomes to purchase goods in the mass market. The decreased demand from the consumers will lead to decreased supply from businesses and the economy will shrink.

Individual consumers are vitally important to the health of the economy. Data from the World Bank shows that 50 to 70 percent of the gross domestic product, in developed economies, is formed by consumer spending (World Bank 2016). Therefore, if the purchasing power of the individual consumers of the economy is diminished, it will lead to decreased overall demand in the economy.

There is, however, an ongoing development in the global economy that would, seemingly, provide a solution for the decreasing consumer demand currently underway in economically developed countries. While the middle-class may be shrinking in economically developed parts of the world such as the U.S. and Europe, the middle-class is actually growing in large developing economies such as China and India. According to Kharas, China and India are the two major countries where the middle-class can be expected to grow during the next two decades. The world economy will be relying increasingly on the consumer demand of the middle-classes of these countries (Kharas 2010). The global economy still has room to grow, as these two Asian powers are demonstrating. Middle-class demand may have reached a ceiling in the economically developed countries but the middle-class is still growing in developing economies. For this reason, overall, global middle-class demand may actually not shrink. It could, therefore, be contended that the market economy will not run to its end simply because of consumer demand decreasing in economically developed countries since the rising middle-class in Asia will provide increasing levels of consumer demand.

The rising middle-class of Asia may prove to be the savior of the global market economy from a short-term perspective. From a long-term point of view, however, it may only be a temporary fix for the system. The force of technology, and the ability to automate middle-class jobs, is such a powerful force that the same development that is underway in economically developed countries will eventually also occur in the developing countries of Asia. Sooner or later, middle-class demand can be expected to shrink in the developing economies as well. The automation of middle-class, knowledge work, jobs may also happen sooner than we would expect, even on a global level, since information technology is progressing at an exponential rate.

This chapter studies the possibility that technological development will risk the existence of the entire market economy. I propose that a financially stable middle-class is a key component to the function of the market economy. If the market economy is left to its own devices, without any governmental interventions, the outcome will be technological unemployment to such a high level that it may lead to the end of the market economy.

4.2. Is job automation getting enough attention?

In all fields of study, as time goes by, a set of commonly accepted beliefs solidify. This also applies to the common beliefs held in the field of *future prediction*. To predict the major trends of the future is an ambitious undertaking and the predictions of many authorities, holding impressive credentials, have often been wrong.

A typical approach in this field of literature that seeks to shed light on the future, is that of recognizing the major trends of the future. It is interesting to note that technological acceleration and job automation are not always included in the lists of important future trends. In his book, *Futurecast,* Shapiro (2009) proposes some major trends that he believes will have the biggest impact on the future. He introduces three of the major forces he suspects will have the greatest impact in the decades to come: (1) The demographic crisis, that can be summarized as being the problems that are caused by there not being enough workers in the population to support the retired citizens. (2) Globalization, which makes it possible for capital, labor, products and even many services to move fluidly between countries. Finally, (3). Decline of communism and the countered embrace of market-based economies in an increased portion of the world.

Trend number two, globalization, allows for an increased amount of people across the world to enter the global workforce. The result of which, is that there is increased competition in the types of knowledge work jobs that have traditionally been more common for people living in developed economies. This trend has already begun impacting the labor markets of developed and developing economies and it only makes sense that the trend will continue into the future. Trend number three, the adoption of market-based economies, will also result in the increase of potential laborers in the global job market.

The view of Shapiro (2009), and many other authorities that attempt to predict the most impactful trends of the coming decades view globalization as one of the main shapers, if not *the* main shaper, of the future. Interestingly, technology is considered to merely be a tool which enables the force of globalization to progress. Thus, by this logic, technology has been relegated to a mere supporting role.

In contrast, there are authorities who are more aware of technological development such as Erik Brynjolfsson, a professor at MIT, and Andrew McAfee, a principal research scientist at MIT, who view information technology as the single most impactful force of the future. According to them, all other forces pale in comparison to the impact that IT development will have on the future. They view technology as the primary force that allows globalization to exist, not the other way around. IT development is the major disruptive force of the coming decades, the other trends such as globalization are viewed as offshoots that technological development allows to exist (Brynjolfsson 2014).

While conventional views may still not hold the development of technology, particularly information technology, as a major disruptive force of the future, I believe that the tide is changing as more and more authorities are beginning to understand the power of technology as a shaper of our world.

4.3. The middle-class: a crucial component of the mass market

It can be argued that the market economy, in its current form, will not survive in the absence of a financially stable middle-class. One way to support this claim is by first illustrating how the market economy functions, after which explaining the role that the middle-class plays in it.

A rather simple relationship exists between the worker, who is also a consumer, and the business employing the worker. This relationship forms the basis of how the market economy functions. It works in the following way. A business employs a worker and the worker receives a salary in return for the energy that she spends in service of the business. From this transaction, the business receives goods that it can sell on the market. Since the worker received money from the business in the form of salary, she can choose to spend this money in the market. When she uses her income to purchase goods from the market, this essentially closes the cycle that forms the basis of the market economy. This simple illustration makes it possible to understand that in order for the market economy to work it takes both a business and a worker/consumer.

Could it be the end of the market economy if a major portion of the workers/consumers in economically developed countries became financially compromised due to a major change, such as widespread job automation?

The economically developed countries of the world are all approximately built in the same way in the sense that the vast amount of their citizens could be considered being middle-class. The middle-class typically works in order to support themselves and their households. It is also important to mention that, most of the income of the middle-class earns is returned quite rapidly back into the mass market, as goods are purchased to meet basic needs as well as to maintain a standard of living which they have grown accustomed to. The middle-class has great purchasing power of which most is directed rapidly back into the mass market.

In contrast, we ought to consider how the people below the middle-class threshold and above the middle-class threshold act in terms of being participants in the mass market. The group below the middle-class, in income level, is not as integral to the functioning of the mass market as the middle-class is. Many people in this group may be unemployed and thus do not participate in work that contributes to the growth of the economy. In addition, this group does not have the same purchasing power as the middle-class does and, therefore, will participate in the mass market by only purchasing their bare necessities. This economically restricted group of the population does not contribute to the growth of the economy to the same degree as the middle-class does.

Then there is the group of people above the income level of the middle-class. This group, of course, consist of a vast amount of different types of individuals and households. For example, some are entrepreneurs who are largely responsible for providing innovative products to the mass market. Yet, others are individuals who have inherited wealth and are able to choose not to work. While, in general, this group of people has vast amounts of money, they only have to spend small percentages of it to meet their basic needs. Meanwhile, large parts of their wealth may be directed into speculative markets. One important consideration is that, if a larger pool of people would have access to the same amount of money of one wealthy individual, and they would divide it up evenly within the group, the combined consumption of the group would almost certainly be directed towards purchases from the mass market. It could be

assumed that this group of people would find more use for the money on the mass market compared to one extremely wealthy individual. For example, it is not reasonable to assume that a millionaire would purchase several laptop computers just because she is capable of doing so. In contrast, a business can expect to sell more of these laptops to one hundred middle-class individuals. It is clear that, from the perspective of the mass market, it is more beneficial to have purchasing power across larger numbers of people rather than concentrated into the hands of few extremely wealthy individuals.

Comparing these three different groups of people of the economy, it could be argued that the middle-class is the group that contributes the most to the healthy functioning of the mass market. And when the aspect is taken into consideration that the workforce is polarizing in a way that the middle-class is becoming smaller and losing its purchasing power, it is reasonable to consider the possibility that the functioning of the mass market is in danger.

The *mass market* consists of purchasers of mass-produced goods (A Dictionary of Media and Communication, 2nd ed.). These mass-produced goods are those that nearly all households in economically developed countries consume, such as mass produced food, electricity, and cell phones etc. The mass market allows for high volume production. And importantly, high volume production allows for *economies of scale* which is the major reason why products can be offered relatively cheaply on the mass market. So cheaply, in fact, that large masses of the population can afford products from most categories offered in the mass market. Without the economies of scale that the mass market enables it simply would not be possible to produce advanced products, such IT products, for the prices that they are currently offered. The prices of laptop computers, for example, can be offered at a price point that most of the inhabitants of economically developed countries can afford.

It could be argued that the mass market is a major reason for the economic growth that has taken place in the economies of industrialized countries. The system in itself is a powerful one. As the people who operate within it pursue their selfish interests by making transactions, the economy grows along with the living standards of the people

within it. This process works according to the ideas of Adam Smith's metaphorical *invisible hand*.

In economically developed countries all of the social classes participate in the mass market. Yet the middle-class, forming the majority of the population, has the greatest impact on the function of the mass market. Without a large base of potential consumers the possibility would not exist for businesses to produce products on a large scale. A demand must exist for supply to be feasible. When products cannot be produced on a large scale, economies of scale is not possible which enables the relatively low prices that consumers have grown accustomed to. Therefore, a large consumer base is a necessity for the mass market which has primarily consisted of the middle-class for the entire history of the mass market.

4.4. The gap between the middle-class and the elite causes economic problems

A strong middle-class has allowed for the creation of great economic wealth during the time of its existence. A case could be made stating that a large middle-class is beneficial for economic growth. William Easterly, of the World Bank, establishes through empirical evidence that higher middle-class income levels are associated with higher overall income levels within the economy and higher economic growth. Supported by his regression analysis he states that: "Per capita income is strongly influenced by the middle-class share…" (Easterly 2001, 323).

While in this thesis I emphasize the importance of the middle-class because it provides a large consumer base for the mass market, Easterly brings forth additional explanations for why the middle-class is important for economic growth. One problem with a small middle-class, according to Easterly, is the higher relative power that is concentrated in the hands of the elite. And the problem with an elite with excessive power is that their selfish interests often times lead to actions which aim to maintain their own position of power. These actions typically come at the expense of the lower classes, and in the long run, these decisions do not support economic growth. Another problem that Easterly mentions is that a smaller middle-class leads to less education which results in decreased human capital in the economy over time. Ultimately this decreased level of

human capital leads to stalled economic growth because the economy does not have individuals who are capable of the type of innovative and productive work that economic expansion requires.

Even though Easterly does not mention the market demand related problem of a small middle-class, which I emphasize in this thesis, what is important is that he corroborates the importance of a strong middle-class and a more homogenous society for enabling economic growth.

4.5. The economic problems caused by job automation

It is not absolutely necessary that a weakened middle-class and the related drop in income levels will lead to the end of the market economy. However, this situation does pose a myriad of problems which, in theory, could mean the end of the economic system that we have gotten used to in developed economies.

In this subchapter, I intend to examine some major obstacles that technological development, combined with job automation, can inflict on the market economy.

4.5.1 Decreased market demand

The main economic concern is that job automation may lead to decreased market demand. The reasoning is that, as technological development continues to allow for ever greater levels of job automation, the overall level of income in an economy would fall among the people who lose their jobs. Earlier in this thesis, it has been established that this group is primarily the middle-class. The resulting decreased purchasing power could threaten economic growth which ultimately relies on market demand expanding.

There are only two entities that can create demand in an economy: the government and individual people. The data shows that consumer spending is typically around 50 to 70 percent of the gross domestic product in the majority of developed economies (World Bank 2016). This means that the spending of individuals is the single largest determinant

of what the overall demand is in nearly all developed economies. Furthermore, most individuals get their purchasing power through the salary provided by their jobs. Ultimately, the main portion of market demand requires that consumers have enough purchasing power which they currently receive mainly through their jobs.

Certainly, businesses purchase things as well. However in this context, purchases between businesses cannot be compared to the purchases that individuals or governments make. Businesses purchase what are called *inputs*. Down the line, these inputs are used to produce products for either individuals or governments. Therefore, if the final demand which comes from an individual or a government is absent, then it makes no sense for the business to make purchases. And if, as a result, businesses shut their operations, then people are also without jobs. The demand from the individual consumer is the “cornerstone” that the entire market system depends on. Without this demand the entire market economy is in danger of going into decline.

The foundation of all of the arguments that are examined in the remainder of this chapter is based on the premise that decreased market demand is a major problem for the health of the market economy.

4.5.2. Inequality related economic problems

Perhaps the clearest case of rising economic inequality can currently be witnessed happening in the U.S. economy. In fact, inequality in the U.S. has risen to levels which resemble those of some non-industrial countries, according to the analysis done by the Central Intelligence Agency. Income inequality in the U.S. is greater than in countries such as Russia, Egypt, and Tunisia (Central Intelligence Agency 2016). This is not what one would expect from a country that has historically been known for its strong middle-class. It is not possible to say that income inequality, in the U.S. or other countries, is caused only by job automation. It is far more feasible to consider job automation to be only one of the many forces that contribute to rising income inequality. One contributing factor is believed to be policy decisions which have enriched the already wealthy individuals and weakened the classes below them (Stiglitz 2015). Whatever the main

cause for the rising income inequality may be, the main point here is that accelerating job automation would also support increased levels of inequality.

Support for the argument that income inequality is rising in America, comes from the fact that income growth has been concentrating to the top percent of the income distribution for some time now. More than half of the increase in U.S. national income between the years 1993 and 2010 went to the individuals within the top one percent of the income distribution (Economist 2012). And while income growth seems to be concentrating in the hands of the wealthiest individuals in the U.S. economy, another fact supporting the argument of increasing income inequality comes from the data which reveals that real wages for *production and nonsupervisory workers* peaked in 1973. When measured in 2013 dollars, these workers earned roughly 767 dollars per week in 1973. At that point in history, this group of workers could be said to have represented more than half of the working population in terms of their income level. Four decades later, this same group only earns on average 664 dollars per week (Ford 2015). Real wages, especially for the middle-class, have been stagnant in the United States now for decades.

Joseph Stiglitz writes in a New York Times article published in 2013, that: “our middle-class is too weak to support the consumer spending that has historically driven our economic growth” (Stiglitz 2013). It is possible to extrapolate from this quotation that adequate consumer spending has been, and is, a major factor in making economic growth possible. It also reveals that Stiglitz, a Nobel laureate economist, agrees that the U.S. middle-class has become too weak financially to contribute what it normally has contributed to the overall consumer spending in the economy.

While Stiglitz believes that income inequality is a major contributor to economic stagnation, surprisingly, not all economist would agree with him. The reason for this being that, while there is clear evidence that income inequality has increased over the last decades, there has simultaneously been an increase in consumer spending.

There are two explanations for this seeming paradox. The first one is rather obvious while the second one is a bit more surprising. Economists Cynamon and Farrazi published research in 2015 that showed that the uptrend that had gone on for decades in consumer spending of 95 percent of the U.S. population has been supported largely

by debt. In other words, if the consumers holding the lowest 95 percent of U.S. purchasing power would have had to rely solely on their personal income for their consumption, then they would not have been able to spend at the level which they did. This type of dependence on borrowed money in order to keep up increased consumption is, of course, unsustainable and cannot be maintained indefinitely. Cynammon and Fazzari believe that the U.S. economy must now face the consequences of income inequality and the accompanying decrease in consumer demand. They argue that economic growth can no longer be sustained by borrowed money (Cynammon & Fazzari 2015).

The second explaining factor for why consumer spending has increased over the past decades comes from the spending habits of the top five percent of earners of the U.S. economy. In the field of economics, there is a widely held belief that if the highest earners manage to capture more income in the expense of the classes below them, then the overall consumer spending in the economy ought to decrease. The reasoning being that, it is not feasible to assume that one wealthy individual would purchase countless of automobiles or cell phones, which of course a larger consumer base would purchase, given that they have adequate purchasing power. According to statistics, however, the top five percent of U.S. households have increased their consumption. This has played a part in keeping the overall consumption of the U.S. economy growing. During the two decades from 1992 to 2012, the top five percent of income households increased their spending from 27%, of the overall U.S. consumer spending, to 38%. During the same time period the consumption of the bottom eighty percent of the households, in terms of income levels, dropped from 47% to 39% (Schwartz 2014). This data supports the argument that a gap is forming in the income levels of U.S. households. While so far overall consumption has not plummeted, as the lower income households have had access to debt and the top five percent of income households have ramped up their spending, this does not appear to be a model that can be sustained for much longer.

The argument that increased income disparity could lead to an economic downturn is based on theoretical reasoning. There is, however, statistical evidence supporting this reasoning. Berg and Ostry, of IMF, wrote a paper in 2011 in which they were able to correlate income inequality and economic growth. While they admit that: “Some inequality is integral to the effective functioning of a market economy and the incentives

needed for investment and growth," they write that, income inequality does seem to have an impact on long-term sustained economic growth. They were able to link income inequality to the length of what they call *growth spells*. A growth spell signifies a time that begins with a growth upbreak and ends with a downbreak. Empirical evidence shows that economic growth does not happen in a totally linear manner, instead economic downturns and periods of expansion occur in cycles. Berg and Ostry found that: "longer growth spells are robustly associated with more equality in the income distribution" (Ostry & Berg 2011, 3).

In their research, they also found that sometimes countries that had relatively high levels of income inequality were able to grow economically. But the difference is that these countries were statistically not able to maintain this growth in the long term. In other words, they found that economic growth is not sustainable in economies where large income disparity is present. They write that: "Over longer horizons, reduced inequality and sustained growth may thus be two sides of the same coin" (Ostry & Berg 2011, 3).

4.5.3. As the middle-class erodes, so does the mass market

The existence of the mass-market is made possible by a middle-class with adequate purchasing power. As it has been emphasized on numerous occasions throughout this thesis, there is clear evidence that the middle-class is eroding in economically developed countries. At least a certain amount of this eroding can be explained by increased job automation. In theory, increasing IT development and the accompanying advances in job automation would cause this trend to accelerate. This constitutes a problem for the mass market economy. The mass-market model of the consumer market has been the standard in all economically developed countries now for decades. And it has been made possible by a middle-class with adequate purchasing power.

One of the most important factors that have allowed for the mass-market to generate high levels of wealth is the economies of scale that is inherent to many of the products that are sold on the mass-market. For example, producing a movie in Hollywood can cost several millions of dollars. Many films that have been produced in the 21st century have cost over two hundred million dollars to produce. The economic feasibility of

producing these products is based on the point that movies are inherently mass-market products. In fact, most Hollywood movies these days are suitable for the worldwide mass-market as people from other countries than the U.S. also consume these films. The reason why this example is brought up is to illustrate the wealth generating power of the mass-market which is held together by a consumer base of millions of people. If such a mass-market for movies did not exist, then it would not be economically possible to produce such expensive high-quality films. Therefore, distributed purchasing power is incredibly important for selling most of the products on the mass market. The economies of scale that come along with producing homogenous products for the mass market can only be achieved through distributed purchasing power.

Theoretically, the consumer market could adapt to a reality where purchasing power was less equally distributed and concentrated in the top 5 or top 1 percent of the households. The market could adapt by shifting production away from mass market products that are generally aimed for the masses and instead focus on producing luxury goods for the wealthy. In this situation, there would also be an incentive to produce ever cheaper products and services for the financially weakened masses of people. This does not, however, sound like a reality that is desirable. Even if the wealthy elite in this scenario were able to consume enough to keep the economy growing, it is likely that the economic hardship of the masses would lead to numerous undesirable consequences that would not be beneficial to society at large. This line of reasoning, relating to the mass market economy and the eroding middle-class, can be found in the book *The Rise of The Robots* by Martin Ford (Ford 2015).

4.5.4. Long term unemployment leads to undesirable spending habits

Rising unemployment levels bring about numerous social and economic problems. Arguably the most significant negative effect, in terms of economic growth and stability, comes from diminished purchasing power and hampered consumer spending. Rising unemployment also introduces another theoretical hindrance to consumer spending through a psychological mechanism that affects consumption habits. This theory was formalized by Milton Friedman and is called the *permanent income hypothesis*. It attempts to describe how an individual spreads his or her consumption over a lifetime.

The theory is based on the notion that the spending of an individual is influenced not only by the amount of purchasing power that is held in the moment but also by the predictions of purchasing power held in the future (Friedman 1957).

Largely determined by the situation in the job market, people can predict unemployment as being long-term or short-term. As people lose their jobs, they naturally try to estimate how long it will take until they find new employment. While there is plenty of variation between individuals, it could be argued that the overall situation of the job market plays a large part in the estimations that person come up with for their own return to the labor force if they have been laid off. If we assume a job market which is polarized and jobs are also being automated, then it could be reasoned that most people, once unemployed, would estimate that their unemployment will be long-term and in some cases even permanent. If an individual comes to this kind of conclusion, it is understandable that he might change his spending habits. Logically the new spending habits would emphasize saving and frugality. In contrast, if the job market generally produces new jobs at a fast pace and unemployment periods were short then people would not change their spending habits very drastically after getting laid off. If a person believes that his unemployment will be short in duration then he will most likely not change his spending habits much at all.

As discussed previously, economic growth requires ever increasing market demand. According to the *permanent income hypothesis*, however, beliefs that unemployment being long-term rather than short-term would lead to increased saving and frugality. This drives down the consumption rate. A job market, where job automation is accelerating and new jobs are not being generated at the same rate as the old ones are disappearing, would not support beliefs of short unemployment periods and consumption habits would change towards saving and frugality.

5 MOVING FORWARD

5.1 Being prepared for the transformation of the job market

From a long-term perspective, advancements in technology lead to economic expansion. Numerous widely accepted growth theories in the field of economics would support this statement. While these theories would predict indefinite growth for the economy through the aid of technological advancement, in the real world, where many more variables exist, this prediction of steady growth may run into obstacles. There may come a time in the future when technology has displaced a vast amount of workers from their jobs. The reason why this is a problem is that workers are also consumers, and the mass market economy requires consumption in order to function. If the purchasing power of consumers has decreased due to rising levels of technological unemployment, then the existence of the entire market economy may be under threat.

Increasing demand in the mass market is a prerequisite for economic growth. For some time now, in the developed economies, a large middle-class has been largely responsible for generating this necessary demand. In an absence of a large consumer base, the mass market would not work in the same way as we have become accustomed to it working.

Therefore, the main problem that comes as a result of increased job automation is the effect that it has on the overall market demand. The focus of this chapter will be to explore the possible solutions for this major economic and societal problem.

This chapter also assumes a future situation where a significant portion of the economy's jobs have been automated. In order to form a more concrete picture, let us say that approximately one-fourth of the economy's current jobs have been automated and the country under inspection has a developed economy. This would translate to unemployment levels greater than 25% since job automation is not the only cause of unemployment. We can also assume that if such a level of jobs automation would have been reached in one developed economy then other economically developed countries would be experiencing similar situations.

This chapter can be viewed as a sort of simulation of a possible future scenario. The purpose is not to predict when this kind of situation may occur or to map out the exact

chain of events leading to this future scenario. The purpose is to simply make the point that this high level of technological unemployment would, most likely, lead to the end of the market economy as we know it. That is, if solutions to fix the problems are not implemented.

In addition to assuming a level of 25% of automated jobs, we can also assume that the development of automation enabling technologies cannot be stopped, or even controlled, in any significant manner. Slowing down the rate of technological development does not fit well with the principles that make up the free market economy. Additionally, administering this type of a control of technology would be an extremely difficult undertaking. Not to even mention the economic problems that would arise if other countries did not implement similar restrictions on technological development. This would, of course, lead to a situation where the countries that did not restrict technological advancement would gain an advantage in the global market. We can, therefore, assume that it is not feasible to assume that the rate of technological development can be restricted.

The main economic problem that would arise from 25%, or higher, unemployment levels would be the effect that it has on the purchasing power of the people. As purchasing power is currently distributed largely through jobs, high unemployment levels would be a major problem. The way the economy currently works is that purchasing power is predominantly linked to the work that the person performs. If a significant number of jobs are eliminated through automation, then this will have a serious effect on the amount of demand that is present in the consumer markets. My argument is that this kind of development would mean the end of the market economy. That is, again, if no actions are taken to find solutions to the problem. If the consumers of the economy have to rely predominantly on the salary from their jobs for their consumption then job automation would be a major problem for the entire economic system.

The lost jobs and the accompanying loss of purchasing power is not the only problem. An additional problem is that even the people who still have jobs in this scenario would most likely begin decreasing their consumption levels. Rationally they would be anticipating a possible future where also they may lose their jobs to automation. As can be seen, the major problem that job automation causes to the economy is the decreased

overall consumer demand. But it is important to emphasize that there are ways to mitigate this problem by affecting the mechanism through which purchasing power is distributed within the economy.

In this chapter, I propose that it is necessary to find, and implement, solutions to the problems that job automation creates. The market economy, left to its own devices, will create increased levels of job automation because it is incentivized to do so. While individual businesses are able to increase their efficiency and ultimately increase their profits through automating jobs, there will come a point in time, however, when the combined efforts to automate jobs will lead to a market situation where consumers are no longer able to purchase the products or afford the services that businesses provide. The dilemma for the businesses is, therefore, that up to a certain point it is profitable for them to downsize employees. Problems begin arising only once the overall level of unemployment, created by job automation, has reached a point where consumer demand has dropped significantly.

It is not feasible to assume that businesses, as individual actors, can solve this problem. It is up to the governments to implement solutions if they are motivated to save the market economy. Since widespread job automation is something that will happen in the future with a significant enough probability, it is crucial to begin preparing for the future with strategies that will smooth the transition to a more automated job market.

5.2. Economic incentives are leading to the end of the market economy

Job automation, in of itself, is not the problem. As established in a previous chapter, job automation will initially only affect the jobs that are repetitive and monotonous by their nature. The reason being that these types of jobs are easiest to automate. These jobs are not necessarily the kind of jobs that are worth people fighting over each other anyways. In the long run, it is probably better to allow machines to occupy these kinds of tasks. Most people will not miss performing these jobs anyways. The primary reason why people want to hold onto these jobs is because these jobs currently provide them a salary.

Once job automation has progressed further and a significant amount of jobs have been eliminated, this would actually free up people to perform higher level tasks. Ultimately then, assuming that society succeeds in transitioning into a more automated economy, job automation would make it possible for the economy to grow even further as people would work on higher level tasks and their job efficiency and efficacy would increase. Therefore, job automation, in of itself, is not a problem.

The problems that job automation creates arise from the consequences it has on the economic and social system of industrialized countries. In order for the current system to run efficiently a near full employment of the working age population is required. It is mainly to this aspect of the economy that job automation creates problems. Would it be possible to alter the system in a way that job automation and unemployment were not problems? Later in this chapter, I will argue that alterations could definitely be made to the system that would allow it to survive. But before that, I will make a point arguing that the *incentives* of our economic system are currently working in a way that is leading to major problems for the existence of the market economy.

To understand how incentives are shaping the direction of the entire economy it will be helpful to study the incentives that drive two main component of the economy: the businesses and the individuals. First, we will explore the incentives of businesses and what the pursuit of these incentives is leading to.

As established earlier, the main incentive for businesses is to produce a profit. Supported by the arguments of Randall Collins, the profit incentive which leads to capitalistic competition, is a major problem for the existence of the market economy (Wallerstein 2014). As businesses pursue greater levels of profits they seek to eliminate as many employees as possible in order to save costs. In the end, humans are more expensive for the business if a machine can perform the same task cheaper. What all of this leads to, in turn, is that many people will be laid off. The incentives of businesses simply work in a way that makes this an inevitability, that is, if no outside interventions are enforced.

On the other hand, the incentives of people who live in economically developed countries is to secure a source of salary for themselves in order to gain the purchasing

power required to partake in the consumer markets. Furthermore, the incentive of most people is to maximize the purchasing power that they are able to gain access to. For most, this translates to pursuing a job that pays a high enough salary as possible. The problem is, if the scenario proposed in this chapter begins unfolding, that it will be increasingly challenging for many to find jobs for themselves.

My argument is that the incentives of the current economic system are leading to an undesirable situation. The incentives of businesses are leading to widespread unemployment through job automation. Ultimately, through a chain of events, this leads to decreased demand for the products and services for the very same businesses that have laid off many of their employees. Job automation also results in many people not being able to fulfill their incentive of finding jobs for themselves which would provide them adequate purchasing power.

The solutions, that will be proposed shortly, do not attempt to change the incentives that influence the market economy. Instead, the solutions will work around them. They will offer a way to sidestep the problems caused by job automation in a way that helps to keep the mechanisms of the free market economy in place.

The core problem with job automation is the effect it has on the distribution of purchasing power in the economy. Purchasing power is currently distributed primarily through job salaries. If the future brings increased levels of job automation and a sufficient amount of new jobs are not created within the economy, then a shortage of purchasing power will be the result for a portion of the people within the economy. As argued previously, the middle-class will be the group that is affected most significantly by these advances in job automation. This is problematic since the middle-class creates a large portion of the demand in the consumer market. The main challenge that the solutions for this situation must address, is to support healthy demand in the markets.

5.3. Suggested solutions for the problems created by job automation

Arguably the most significant problem that job automation creates, for the economy and society, is the impact it has on the spread of purchasing power. Particularly, the problem

is that purchasing power concentrates increasingly in the hands of the wealthiest individuals in the economy. While this impacts the health of the markets in a negative way, it also poses many societal problems. Without a doubt, this is a problem which needs to be addressed. A solution is needed which allows people to have purchasing power regardless of whether they are employed or unemployed.

The intention is to introduce the reader to some possible solutions that would guarantee that people have access to purchasing power regardless of their employment status.

5.3.1. Basic income

One solution to the problem of purchasing power being unevenly divided in the economy would be to implement a policy for *basic income*. “A basic income is an income unconditionally granted to all on an individual basis, without means test or work requirement. It is a form of minimum income guarantee...” (Basic Income Earth Network 2016). The basic income would differ from the economic safety-nets that currently exists in many economically developed countries. First of all, the basic income would be paid to all citizens without review of whether they are actually in need of the income or if they are able to meet their basic survival needs. Also, it is paid without the requirement to accept job offers by government agencies or other organizations. The basic income is paid to all of the citizens of the country without conditions. The basic income is not by any means a new idea but my argument is that it would be a beneficial policy, especially for developed economies, to adopt in light of a probable future situation where unemployment levels will be rising.

The basic income has been supported by many authorities over the years. Perhaps one of the most well-known authorities supporting the basic income is Friedrich Hayek. In *Law, Legislation and Liberty* Hayek recommends the basic income as a possible policy for the government to implement. He emphasizes the point that individuals in the current market-oriented society cannot by themselves, in all situations, be expected to protect themselves from economic hardship. He suggests that there ought to be a safety net for those individuals who, for whatever reason, cannot make a living for themselves through the market (Hayek 2012).

A system, such as the basic income system, could be tremendously beneficial from the perspective of countless people losing their jobs through technologically driven job automation. It would allow these people a way to meet their basic needs. And perhaps most importantly, since the basic income would be offered unconditionally to all individuals, those people who are unemployed could accept part-time jobs without having to worry about losing their basic income source. This is a major problem for people living in countries where *conditional* minimum income systems are in place. In these systems, one may lose their right to receive monetary benefits if they accept any kind of work. In general, people would be freer to pursue actions which benefitted them economically, as well as the society at large, if they did not have to worry about their actions leading to the loss of unemployment benefits.

In theory, the basic income would also be a beneficial policy for the health of the consumer market. As argued previously, purchasing power distributed more evenly across the society would help the survival of the mass market. The basic income system would ensure that purchasing power would be distributed in a way that made it feasible to keep on producing mass-produced products for the consumer markets. To better clarify this argument, an opposing situation could be considered where the purchasing power was concentrated more unevenly and primarily amongst the wealthy elite. It could be argued that this kind of scenario could lead to a downfall of the market economy as overall consumer demand would decrease due to the simple fact that the classes below the elite would not have sufficient purchasing power.

Also, worth mentioning is that the basic income system could also foster a more fertile environment for entrepreneurship. As the basic income would guarantee that people would meet their basic needs, regardless of how they chose to spend their waking hours, it might lead to more people pursuing entrepreneurial endeavors. There would be less financial risk to individuals if they did not succeed in their enterprises, which ought to make entrepreneurship a more attractive option for many people who are without a job. This would be beneficial from a societal perspective since the unemployed would be doing something productive, and it can be assumed that many of the new enterprises would benefit the society and grow the economy.

For these reasons, the basic income could solve the biggest problem caused by job automation: uneven distribution of purchasing power. It would directly put purchasing power in the hands of those people who would otherwise struggle financially due to a lack of having a job. The end result would be that sufficient demand could be maintained in the consumer markets.

Even though the basic income is explained here in very simplistic terms, it is worth mentioning that in reality there are many challenges in implementing this system. If a basic income system were implemented it can be expected that some problems would surface. And while there are many supporters of the basic income system, there are also adamant proponents. Therefore, politically speaking, implementing a policy such as the basic income would be a challenging undertaking, even if implementing it was ultimately absolutely necessary for the survival of the free market economy.

The basic income is not the only possible policy to implement in a situation where unemployment levels are rising. Among the alternatives, there is also policies such as the *negative income tax* which was supported by the Nobel prize-winning economist Milton Friedman. Similarly to the basic income system, the negative income tax would work in a way that would secure an unconditional income source for the unemployed. However, it would differ in the sense that it would arguably incentivize people more strongly to earn an income for themselves compared to the basic income system. Most importantly, the negative income tax system is an example of another system which could provide a solution to the main problem caused by job automation which is the uneven distribution of purchasing power.

5.3.2. Taxation related solutions

Changing our policies relating to taxation is also one course of action that could help with the problems that job automation creates. Taxation is, of course, one means through which government can enforce incentives. The argument of this thesis is that particularly economically developed countries are transitioning from labor-intensive economies to being more capital-intensive. If this is true, then it makes sense for governments to also transition away from gathering taxes through employees, and

instead find a way to tax businesses on other grounds. The obvious problem for governments, if they rely too heavily on collecting taxes through employees and those businesses that have the largest amount of employees, is that the amount of taxes that they are able to gather through this method will shrink in the future.

Another problem that arises from taxing businesses based on the amount of their employees is that it places an additional incentive on the businesses to find ways to employ fewer workers. The more costs associated with hiring people, the less motivation businesses will have to employ people. If businesses can find another way to get the necessary work done, that an individual could have been hired for, they will most likely take that option. As technology keeps on developing, businesses will have more options for finding alternatives to human workers. In contrast, if we consider a scenario where businesses did not have to pay taxes on their employees, it would more often be an attractive option for them to hire a human workers for a jobs.

Taxation policies that would not tax businesses based on the number of employees they had on their payroll would incentivize them to hire more employees. This would provide help with the foreseeable unemployment problems in economically developed countries. Ultimately it is not necessary for governments to tax businesses through employees. Other means of collecting taxes can make up for the revenues that a government loses if it chooses to eliminate this tax source. To further incentivize business to hire more employees, governments could tax those the less labor-intensive businesses more heavily. Similar taxation related reasoning can be found in Martin Ford's (2015) *The Rise of The Robots*.

5.3.3. Supporting entrepreneurship

If businesses are not offering jobs, then people could be supported in creating jobs for themselves. Supporting entrepreneurship is one potential solution to the problem of technological unemployment. If more people considered entrepreneurship a possible way of making a living then the unemployment level would also decrease. Many people that would otherwise need financial support from the government would be able to provide for themselves.

However, the harsh fact is that all businesses do not succeed. Therefore, not all of the people would succeed in providing for themselves through the businesses that they create. However, for most people the risk of entrepreneurship would be worth taking, especially if the professional skills they have previously offered in the job market are no longer in demand.

Also, in theory, the lack of jobs in the marketplace does not mean that all needs in the marketplace have already been met. It could be argued that consumers will always continue to have unmet needs, no matter what their external situation. Savvy entrepreneurs can find ways to fulfill these needs through their own creativity.

Entrepreneurship is, of course, a path that many choose for themselves regardless of how good or bad the situation of the job market is. However, if job automation becomes more widespread and unemployment numbers rise, it is my argument that governments should attempt to make entrepreneurship a more attractive option for people. There are numerous ways that a government can make entrepreneurship a more attractive and practical option for individuals. The policy change examples that follow are not intended as a plan for any specific government, they are simply brought up in order to demonstrate that a government can enforce policy changes that would make entrepreneurship a more attractive option.

Arguably the most important aspect, that would make entrepreneurship a more viable option, would be to make sure that those who choose entrepreneurship would not lose any possible benefits from the government because of starting their own business. If people have to worry that starting a business will put them in economic risk then there is a smaller likelihood that they will pursue this alternative. Another policy that would most likely encourage entrepreneurship would be to minimize the amount of paperwork and bureaucracy that is involved with starting one's own business. If the amount of upfront paperwork involved to start a business were smaller, it could be expected that more people would find it a more attractive option to see if their business idea has any traction in the marketplace. Finally, the public education system could be amended in a way that entrepreneurship and entrepreneurial skills were taught in school. This would prepare more individuals for entrepreneurship and higher success rates for entrepreneurship

could be expected. These three policy suggestions are by no means the only things that a government could do to support higher levels of entrepreneurship. They are, however, prime examples of policies which would encourage entrepreneurship and thus mobilize many of the unemployed.

6. CONCLUSION

Businesses are incentivized to automate as much of their operations as possible. The main benefit businesses receive from job automation is the increased efficiency that results in increased profits. As businesses are primarily motivated to make a profit, it is clear that automation will continue progressing.

From a historic perspective, job automation has been a powerful force. It has significantly affected the types of jobs people hold in the economy. For example, a major part of the population in Great Britain were farmers before the Industrial Revolution. Now approximately only one percent of people in economically developed countries, such as Great Britain, hold farming jobs.

The most recent major development in the field of job automation is the automation of knowledge work. For many decades job automation primarily only affected manual labor. Job automation has affected manual labor jobs at increasing levels, as societies have become better at automating mechanical power. In the beginning stages, it was only the simplest of manual labor jobs that were automated. Gradually, as technologies have developed, it has been possible to automate higher level manual labor jobs such as those found in factories.

The types of jobs that are being automated, at a specific point in time, are closely connected to the technologies that are developing the fastest at that moment. Currently, the greatest advancements are being made in the field of information technology, and as a result, new inventions are enabling businesses to automate IT related tasks. In other words, job automation is beginning to affect knowledge work jobs.

The automation of manual labor jobs can be called the first wave of automation. This phase essentially lasted from the Industrial Revolution all the way to the late 1900s. Now we are in the beginning stage of what could be called the second wave of automation. This specific wave of automation primarily involves automating knowledge work jobs. During the first wave of automation, as manual labor jobs began disappearing, manual workers began gradually shifting towards knowledge work jobs. While this was a major transformation in the job market, it unfolded slowly over several decades. The second wave of automation can be expected to work differently. The reason is that the primary technologies that are responsible for the second wave of automation are developing at an exponential rate. This means that the automation of knowledge work jobs will happen in a shorter period of time. This will make it a harder process to manage by society.

The problem with significant amounts of knowledge workers losing their jobs is figuring out what kind of employment they will transition to. As manual labor jobs have been automated, the masses have been able to transition into knowledge work jobs. But where can knowledge workers to transition to next? Currently it is hard to see any kind of work that these workers could “move up” to.

In the modern developed economies, knowledge workers form a major part of the middle-class. Therefore, if the second wave of automation primarily affects knowledge workers, then this means that the middle-class will also suffer. And the reason why this is a significant problem is that the middle-class can be considered the “cornerstone” of the market economy. The middle-class creates a major portion of the demand in the consumer markets. The middle-class also makes it feasible for many of the mass produced products to exist. It would be a major challenge to the market economy if this specific group of people began losing their jobs in significant numbers.

The main problem caused by the eroding middle-class is the decrease in market demand. This is why job automation could ultimately lead to broad economic problems as it would cause decreased demand in the consumer markets. The outcome could even mean the end of the market economy.

Luckily the situation is not hopeless. There are certain policies which can be implemented in order to aid in the negative externalities that will result from the second

wave of automation. The responsibility lies in the hands of the governments to implement the kind of policies that will help people in the transition towards a more automated society. Policies ought to be implemented also that give the market economy the greatest chances of surviving. Arguably the most important policy to implement would be one that allowed for purchasing power to be distributed more evenly throughout the population. This would not only provide invaluable help to many people who lose their jobs to the forces such as job automation, it would also ensure that a significant enough amount of purchasing power would remain in the consumer markets to support the growth of the economy. If governments are able to put the right policy changes in place, it is not a necessity that job automation will lead to the end of the market economy.

The goal of this thesis was to describe how job automation will affect the economy in the near future. The automation of knowledge work jobs, especially, will impact the job market and the entire economy in the coming years. Hopefully, the readers of this thesis have been motivated to consider their own career and assess how job automation may affect their own lives in the future. As advances in information technology make it possible for greater numbers of knowledge work jobs to be automated, it is becoming increasingly important to make career decisions with automation in mind.

While this thesis focused mostly on the negative aspects of job automation, it is important to remember that there are also numerous positive aspects relating to this development. From a historic perspective, we can see that job automation has led to better quality jobs for many people, especially in developed economies. The contrast between a typical factory job during the Industrial Revolution compared to a typical factory job of today is immense. Technological development and job automation, combined, have also elevated people to performing higher level jobs such as many of the knowledge work jobs of today. Job automation also holds the promise of automating many of the monotonous jobs that are still present in the modern economy. Eventually, this should free people to more rewarding higher level jobs.

From a long-term perspective technological development and job automation can be expected to also grow the economy. But in order for this to happen, it is vitally important that we successfully manage the coming transformation in the job market caused by the

automation of knowledge work jobs. We will inevitably experience growing pains due to this second wave of job automation. If society is able to make this transition successfully then perhaps a better reality awaits us on the other side.

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